Q1. The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial and final acceleration using the entire data

| $t$: | 0 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|
| $v$: | 0 | 3 | 14 | 69 | 228 |

Q2. Find the values of $y'$ and $y''$ at $x = 51$ and $x = 55$ from the following data:

| $x$: | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
|---|---|---|---|---|---|---|---|
| $y$: | 3.6840 | 3.7084 | 3.7325 | 3.7563 | 3.7798 | 3.8030 | 3.8259 |

Q3. From the following table, find the value of $x$ for which $y$ is maximum and find this value of $y$

| $x$: | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| $y$: | 0.205 | 0.240 | 0.259 | 0.262 | 0.250 | 0.224 |

Q4. From the following table find the minimum value of $y$

| $x$: | 0.60 | 0.65 | 0.70 | 0.75 |
|---|---|---|---|---|
| $y$: | 0.6221 | 0.6155 | 0.6138 | 0.6170 |

Q5. Derive Newton-Cote's quadrature formula for equidistant interval. Deduce rules for $n = 1$, 2, 3.

Q6. Evaluate $\int_4^{5.2} log_e x \ dx$ by trapezoidal rule by taking $h = 0.2$.

Q7. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using

(i) Trapezoidal rule,
(ii) Simpson's 1/3 rule,
(iii) Simpson's 3/8 rule.
(iv) Boole's Mathod
(v) Weddle's Method

Q8. Evaluate $\int_0^{0.96} f(x)\,dx$ where $f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$ by using

(i) Trapezoidal rule,
(ii) Simpson's 1/3 rule,
(iii) Simpson's 3/8 rule.
(iv) Boole's Mathod
(v) Weddle's Method

Q9. The velocity $v$ of a particle moving in a straight line covers a distance $x$ in time $t$. they are related as follows:

| $x$: | 0 | 10 | 20 | 30 | 40 |
|---|---|---|---|---|---|
| $v$: | 45 | 60 | 65 | 54 | 42 |

Find time taken to traverse the distance of 40 units.

Q10. A river is 80 ft wide. The depth $d$ in feet at a distance x ft from ane bank is given by the following table:

| $x$: | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| $d$: | 0 | 4 | 7 | 9 | 12 | 15 | 14 | 8 | 3 |

Q1. Using Taylor series method solve $\frac{dy}{dx} = 3x + \frac{y}{2}$ to $y(0) = 1\ at\ x = 0.1\ and\ x = 0.2$.

Ans: $1.06652, 1.20241$

Q2. Use Taylor series solution to solve $\frac{dy}{dx} = x^3 + y$ for $x = 1.1, 1.2, 1.3, 1.4, 1.5$ with the initial condition $y(1) = 1$.

Ans: 1.225, 1.512, 1.874, 2.327, 2.889

Q3. Consider the initial value problem $\frac{dy}{dx} = y - x^2 + 1,\ y(0) = 0.5$ Find $y(0.2)$ by Euler's and Modified Euler's Method

Ans: $0.8, 0.828$

Q4. Apply Runge-Kutta method to find an approximate value of $y$ for $x = 0.2$ in steps of 0.1, if $\frac{dy}{dx} = x + y^2$ given that $y = 1$ when $x = 0$.

Ans: 1.2736

Q5. Using Runge-Kutta method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that $y(0) = 1$ at $x = 0.2, 0.4$.

Ans: $1.19598, 1.3751$

Q6. Solve numerically $\frac{dy}{dx} = x^2 + y^2 - 2$ using Milne's predictor corrector method for $x = 0.3$ given the initial value $x = 0, y = 1$. The values of y for $x = -0.1, 0.1, 0.2$ should be computed by Taylor series expansion.

Ans: 0.6148

Q7. Solve numerically $\frac{dy}{dx} = 2e^x - y$ at $x = 0.4$ and 0.5 by Adams- Bashforth and Moulton method, given that $y(0) = 2$.

Ans: $y(0.4) = 2.1621,\ y(0.5) = 2.2447$.